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The divide between operational art theorists and systems-type thinkers became evident in 2008 when General Mattis, then commander of U.S. Joint Forces Command, halted the championing of the Effects Based Operations concept. Gen. Mattis concluded that EBO was not understood nor properly utilized, and sent a memorandum to his command ordering it to be removed from joint lexicon. Even after its removal, EBO's allure has continued to spark debate. This paper acknowledges the shortfalls of EBO, but identifies the need for the incorporation of a systems-type approach into operational design. It explains the asymmetric nature of twenty-first century conflicts requires a design process that encompasses operational art and systems-type approach. Arguments against the systems-type approach are outlined first; followed by examples and reasons why this approach must be acknowledged in current and future operations. The paper's main discussion provides new definitions for previous EBO terms, and describes their utility in today's operational environment via an illustrative example. Finally, the paper concludes that the systems-type approach to operational design needs to be reinvigorated, and incorporated into joint doctrine, in order to keep pace with the lawless enemies of the twenty-first century.

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NAVAL WAR COLLEGE
Newport, R.I.

OPERATIONAL DESIGN THAT SYNTHESIZES ART AND SCIENCE

by

Jeffrey J. Abbadini

Lieutenant Commander, USN

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature: _____

04 May 2011

Contents

Abstract

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"It should be the aim of grand strategy to discover and pierce the Achilles' heel of the opposing government's power to make war. Strategy, in turn, should seek to penetrate a joint in the harness of the opposing forces. To apply one's strength where the opponent is strong weakens oneself disproportionately to the effect attained. To strike with strong effect, one must strike at weakness."

- Sir Basil H. Liddel-Hart (*Strategy*)

Introduction

Operational art theorists have historically provided planners and commanders the necessary ideas and concepts to carry out many successful operations. Their traditional approach worked well for conventional force-on-force conflicts and provided structure to the operational design process. However, today's operations are predominantly asymmetrical irregular-warfare (IW) conflicts versus complex networks of state and/or non-state actors, such as counter-insurgency (COIN). IW conflicts not only epitomize the asymmetric spectrum, but U.S. military dominance will solidify our place in this new spectrum of warfare, for future conflicts as well.[1] Because asymmetric warfare will remain at the forefront of all military operations, a systems-type approach must be incorporated into operational design giving commanders the tools to achieve the greatest effect on the enemy by exploiting vulnerabilities in networks, and disrupting their entire balance.

Planners and staffs may still utilize the traditional approach (academically) to identify enemy and friendly-force critical factors, but asymmetric conflicts create complexities in this approach that make important concepts such as the enemy's center of gravity (COG) more elusive than ever. Because of technology, one can assume that future conflicts will no longer be force-on-force wars of attrition at the operational level and above. They will instead be wars consisting of complex, interconnected networks that require an analysis of network interrelationships, operational effects, and the COG of the enemy. A systems-type approach of operational design conceived in Air Force doctrine, embraced in net-centric warfare, and seen throughout joint operational planning, is Effects-Based Operations (EBO).[2] The EBO

approach, with *effect* defined as "the physical and/or behavioral state of a system that results from an action, a set of actions, or another effect,"[3] has been subject to many critical reviews throughout the past two decades. However, many EBO concepts remain in joint military publications and still have utility in current operational planning and execution. This paper will present arguments for and against a systems-type approach, and it will conclude that this approach must be incorporated into operational design in order to account for complexities of twenty-first century warfare.

Traditional Thinking

The systems approach, and more specifically EBO, has evolved and devolved in each service, and the joint community as a whole, throughout the past two decades. The United States Joint Forces Command (USJFCOM) had been the leading proponent of the concept through 2008 to include producing the *Commander's Handbook for an Effects-Based Approach to Joint Operations* (EBO Handbook) in 2006. However, a number of traditional military theorists and professionals have discounted the concept's legitimacy. In his June 2008 memorandum as Commander USJFCOM, General Mattis, USMC gave his perspective on the shortcomings seen in EBO, and provided guidance that removed EBO and its related concepts from USFJFCOM training, and doctrine development.[4] Much of Gen. Mattis' contention was because of confusion in the definitions of terms that developed between services, combatant commanders and multinational partners.[5] He concluded that EBO proponents also had trouble defining terms, and they also contributed to the confusion.[6] Lieutenant General Van Riper, USMC (Ret.) agreed with Gen. Mattis' argument in a 2009 *Joint Forces Quarterly (JFQ)* article and went further by saying EBO proponents "were

oblivious to the realities of interactively complex systems".[7] LtGen. Van Riper did concede that EBO, as originally envisioned by U.S. Air Force Colonels Warden and Depetula, had its utility in targeting plans. But he felt that it lost its utility in other operations because of the loosely coupled relationships between elements such as economies, and social groups.[8]

Traditional military theorists also voiced their concern in regards to the systems approach of EBO. In Issue 41 of *JFQ 2006,* Dr. Milan Vego of the U.S. Naval War College argued that "EBO is in fact the antithesis of operational thinking and practice," and continued by arguing that proponents of EBO view warfare as only a science and not a combination of art and science.[9] Another main point of contention centered on the term *effects* in EBO. In this same article, Dr. Vego discounted EBO by stating "the logical thing is to predict effects *after*—not before—the accomplishment of the objective."[10] However, it is completely illogical to attempt to predict something *after* it happens. Adding to further confusion, Dr. Vego described the COG, in his book *Joint Operational Warfare,* as "a source of leverage whose serious degradation, dislocation, neutralization, or destruction would have the *most decisive impact* on the enemy's or one's own ability to accomplish a given political/military objective."[11] In this context, and by referencing literary definitions, the phrase *most decisive impact* undeniably resembles *most decisive effect*.

Vego's argument is a perfect example of how EBO concepts do fit into operational design, yet by only referencing the context of his argument; one might conclude there is no longer a need for systems-type thinking. Vego further asserts that EBO does not follow conventional logic, and discounts its utility in regressive planning.[12] He, along with other traditional thinkers, disregards EBO's interoperability with traditional methods involving critical factor analysis and COG identification. Traditional operational art will continue to

provide valuable direction in the design process, but its symmetrical concepts may not keep pace with the asymmetrical aspects of operations that will consistently challenge our military.

Vulnerabilities in Traditional Thinking

Operational design has evolved throughout the years, but has maintained its linear approach because of the symmetrical interpretations of works from great thinkers like Carl von Clausewitz' *On War*. Central to his approach is the concept of the *hub of all power and movement,* or the center of gravity.[13] Centuries after Clausewitz, COG identification remains at the forefront of operational design. However, the multiple interpretations of the COG, which exist throughout military academia and operational planning rooms, make it an elusive task.

Today's traditional thinking still implies a more linear approach to defining the objective, conducting a critical factor analysis of the critical strengths, critical weaknesses, and critical vulnerabilities; and ultimately proceeding to identify the COG. Traditional theorists like Vego, also maintain the COG is more definitive than what EBO constructs provide.[14] Dr. Vego describes critical factors in terms of critical strengths, critical weaknesses and critical vulnerabilities listed in Table I below.[15]

> **Critical Strengths:** friendly or enemy capabilities considered *essential* for accomplishing a given or assumed military objective. In military terms, critical strengths are primarily sources of physical or moral potential/power or elements that integrate, protect, and sustain specific sources of combat potential/power.
>
> **Critical Weaknesses:** those sources of power that are considered essential for the accomplishment of the objectives but are at the same time grossly inadequate to perform their intended function or task.
>
> **Critical Vulnerabilities:** those elements of one's military or nonmilitary sources of power open to enemy attack, control, leverage, or exploitation.

Table I

Once planners identify the critical factors, this design concept is meant to enable them to identify the COG which Dr. Vego defines as a source of strength.[16] As read in the *Traditional Thinking* section, this COG is described as the source of power that would have the *most decisive impact* on the enemy.[17] Dr. Strange presents a similar process illustrated by his view of the critical factor concepts in terms of *critical capabilities* (CC), *critical requirements* (CR) and *critical vulnerabilities* (CV) when attempting to identify/attack the COG (CG). His concept, seen in his various works as CG-CC-CR-CV, has been adopted and used in current joint planning publications. Table II defines these terms as adopted in joint doctrine.[18]

Critical Capability: A means that is considered a crucial enabler for a center of gravity to function as such, and is essential to the accomplishment of the specified or assumed objective(s).
Critical Requirement: An essential condition, resource, and means for a critical capability to be fully operational.
Critical Vulnerability: An aspect of a CR, which is deficient or vulnerable to direct or indirect attack that will create decisive or significant effects.

Table II

Dr. Strange also maintains that there should ideally be only one COG, but realizes that it is sometimes difficult to determine only one.[19] This realization highlights some shortcomings in the exclusively traditional approach to operational design. First, it concedes that identifying one specific COG is difficult, even in conventional warfare. Second, when considering the complexities seen in the borderless spectrum of twenty-first century conflicts, looking for a single COG without being able to identify the interrelationships of the entire complex system seems to be an exercise in futility. Traditional critical factor analysis and COG determination have their utility in symmetrical wars of attrition by drawing similarities to that of a solid symmetrical object with balanced mass. A simple physics example of the symmetrical object would be a solid block or sphere where the exact center of mass can be found and, therefore,

a center of gravity can easily be determined.[20] In his work, *CENTERS OF GRAVITY & CRITICAL VULNERABILITIES: Building on the Clausewitzian Foundation So That We Can All Speak the Same Language,* Dr. Strange concedes that frequently there are multiple centers of gravity at any given level of war and it is the staff's job to determine the interrelationship between the multiple COGs and devise effective strategies against them.[21] This explanation attempts to shore up faults seen in the traditional (symmetrical object) approach, but perpetuates the confusion in operational planners and staffs. An example of this confusion is replicated in military academia when studying and analyzing past operations. Because of the numerous interrelated elements of any given operation, it is nearly impossible to find unanimous agreement on the identification of a single COG. Even with the luxury of hindsight, the lack of unanimous agreement usually relegates groups to a variation of this concept such as identifying a COG for each phase of an operation.

Although much of Clausewitz' work has been studied and interpreted by many, to include the two respected theorists listed above, each branch of service also added their own confusion to the design process.[22] The misunderstanding was caused by each service viewing the COG and other design concepts through their individual service perspectives. What constitutes the center of gravity; is it the hub of all power, or is it a critical capability, or a critical vulnerability, or is it none of these? In *Marine Corps Doctrine Publication One* (MCDP 1) of 1997, the Marines acknowledged the importance of finding the center of gravity but also looked to focus effort on critical vulnerabilities. MCDP1 followed the joint definition of critical vulnerability in that, if exploited, will most significantly damage the enemy's ability to resist.[23] MCDP 1 went on further to say that COG and critical vulnerabilities are complementary; and critical vulnerabilities are an indirect path to the

center of gravity.[24] Sparking more thought, MCDP 1 provided a systems approach to operational design by acknowledging there could be more than one center of gravity. Since there may be more than one, it may be necessary to attack each lesser center of gravity and or critical vulnerability in order to produce the greatest effect.[25]

In the 2001 edition, MCDP 1-0 evolved with a new term; commander's battlespace area evaluation (CBAE). The term CBAE includes the commander's vision of the operation's purpose, the desired effects on the enemy, and how he/she wants to accomplish the objectives.[26] It maintains the importance of identifying critical vulnerabilities of both friendly and enemy forces and, in order to more effectively defeat the enemy, we must exploit their vulnerabilities. Furthermore, we must identify our own critical vulnerabilities in order to guard our center of gravity more effectively.[27] CBAE gives the commander the opportunity to analyze the battlespace through a systems approach by analyzing the mission and its effects, but also allows them the opportunity to use operational art by injecting their "vision" in the operational design process.

As discussed earlier, the systems approach of EBO has been at the center of much disagreement. A consistent misinterpretation of terms by its opponents and proponents alike prohibited its development in individual services and throughout the joint community. USJFCOM attempted to standardize terms when they produced the EBO Handbook, but misinterpretation continued and forced Gen. Mattis to expunge EBO concepts from any work originating from USJFCOM. Although it was removed from USJFCOM's lexicon in 2008, many concepts and terms appear in conversation, planning, and joint documents today. Some terms that originated from earlier EBO concepts can still add value to the design process, because their definitions are universal. These terms include: *system, objectives,* and

tasks.[28] Other terms like *effects*, *nodes*, and *key nodes* increased the divide between traditional and systems-type thinkers, because of the literary misinterpretations of terms perpetuated by opponents and proponents alike. Both sides added their own confusion, and neither side could rebut the other's claims. Table III provides terms, as defined in USJFOM's *Commander's Handbook for an Effects-Based Approach to Joint Operations2006,* and illustrates the shortfalls of these definitions. It is especially apparent that the terms creating the most conflict have the least descriptive definition.

> **System:** A functionally, physically, and/or behaviorally related group of regularly interacting or interdependent elements; that group of elements forming a unified whole.
>
> **Node:** An element of a system that represents a person, place or thing.
>
> **Key Node:** A node that is related to a strategic or operational effect and/or a center of gravity.
>
> **Link:** An element of a system that represents a behavioral, physical, or functional relationship between nodes.
>
> **Objectives** prescribe friendly goals.
>
> **Effects** describe system behavior in the operational environment
>
> **Tasks** direct friendly action.

Table III (from JFCOM *EBO Handbook* 2006)

Joint Publication 3-0, *Joint Operations,* (JP 3-0) specifically states "At the strategic and operational levels, commanders and staffs should understand the relationships (links) between system nodes when considering whether a direct or indirect approach is the best way to produce a desired operational or strategic effect."[29] This joint planning document maintains the COG concept in terms of Clausewitz and describes critical factors in the same terms seen in Dr. Strange's works. However, it strays from traditional operational art when it asserts that a JFC staff take a systems perspective of the *operational environment*. The *operational environment* encompasses political, military, economic, social, infrastructure, and information (PMESII) networks illustrated in Figure 1, and provides the necessary

systems perspective for the staff to understand the interaction between influential networks, and ultimately understand the enemy's COG.[30]

Traditional operational thinkers oppose a systems-type visualization of the *operational environment*, but their approach alone fails to provide a framework of second and third order relationships in complex environments of the twenty-first century. Instead of a critical factor analysis, the operational environment must be observed and analyzed in terms of network interactions within the entire system. Understanding the interrelationships of the networks within the system enables commanders and their staffs to better understand the operational environment. This allows them to more efficiently exploit enemy critical vulnerabilities and produce greater effects on the COG.[31]

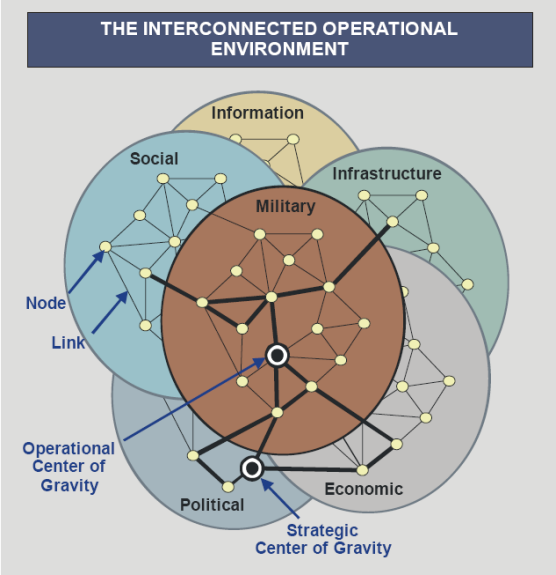

Figure 1. Interconnected Operational Environment. (Reprinted from JP 3-0)

Many opponents of this approach also find fault in the systems analysis. They claim effects cannot be predicted when considering the intangible aspect of human nature.[32] However, to systems proponents, it is wrong to disregard the predictive aspect of systems

analysis; especially in asymmetrical cases. It is through this analysis that a more efficient and effective means of operational design provides commanders and staffs the necessary bridge between theory and practice in actual operations.

Finally, opponents claim that the systems approach is too data intensive and requires perfect intelligence. There is no argument that perfect intelligence can never be achieved, but near real-time intelligence can be almost as valuable. During the two tumultuous decades of the EBO evolution, our ISR and communications systems have made continuous strides in real-time information fed to the commanders and staffs. No matter whether it is in the COIN environment or a future state vs. state conflict, our battlespace will almost never be without persistent ISR that will provide real-time intelligence to the commander. A staff that is well-versed in the systems approach can continue to analyze the intelligence and provide an updated assessment to the commander. The commander can then inject his own vision and direction into the continual design process.

Methodically Attack the Network

Operational art is still necessary in operational design, but it must also be acknowledged that a traditional approach alone cannot sufficiently affect the issues in today's operations and quite possibly any major combat operation of the future. Technology, and advancing weapons systems, will keep us in the asymmetric realm; at the operational level and above. The physics analogy, if taken literally, illustrates the COG as a "symmetrical object" with a more physical center of all power. Considering Clausewitz's COG definition in *On War*, "…the hub of all power and movement, on which everything depends. That is the point against which all of our energies should be directed,"[33] traditional interpretation drives

planners to the symmetrical interpretation of the COG, and many times steers them in the wrong direction.

Instead of focusing on the misinterpretation of terms, operational designers must understand the context and utility of the systems approach to asymmetrical warfare. First, through another physics analogy, one can assume the center of gravity will not be in the exact center of the asymmetrical object, but it will in fact be at a mean center or a focal point.[34] Looking further at an object that is not only asymmetrical, but also flexible; its mean center will move as the object itself flexes or moves. A moving COG will, therefore, throw the object off balance if not controlled. Keeping the physics analogy in mind, we can now put it in terms of operational design. Clausewitz' statements, "small things always depend on great ones, unimportant on important, accidentals on essentials" and "if the enemy is thrown off balance, he must not be given time to recover,"[35] illustrate his acknowledgement that warfare is made up of multiple system interactions that maintain a force's balance. Furthermore, Clausewitz' *hub of all power and movement* may still be called the center of gravity, but the center of gravity more appropriately should be interpreted as the mean center of the system where the balance of power exists.

Strong forces maintain their balance by coordinating critical factors throughout the system. The more polished and refined the coordination, the more balanced and stronger the force. Critical factors and their relationships must be analyzed in order to more effectively find the vulnerabilities within the system and ultimately disrupt the enemy's balance. Critical vulnerabilities can exist in the traditional sense, within other critical factors, where this could be considered tangible. They can also exist in the *links* of the systems, or what may be considered the intangible relationships. In either case, critical capabilities or nodes

within the EBO type system can possess vulnerabilities, and the relationships or links between the nodes can also manifest vulnerabilities. An example in larger terms would be an analogy of an alliance between two forces. Whether it consists of two strong forces, two weak forces, or a strong and weak force, an alliance is usually formed to unify strength. Obviously, a weak force would possess vulnerabilities, but the strong force may also be vulnerable. The alliance or the link between the two forces can also be a critical vulnerability and, if fractured, would degrade the unified strength. Therefore, whether attacking the critical vulnerability directly at the weak force or indirectly against the alliance, it is up to the strategist to determine the course of action with least resistance.

Building from the analogy of an alliance, it does not matter the size of the system as long as you understand its interrelationships. This understanding is especially crucial at the operational levels and above, because it gives the commanders and staffs the ability to observe the entire operational environment, accurately identify the critical vulnerabilities, and effectively attack the balance of the system. Operational commanders are charged with maintaining the balance of friendly forces, and determining the most efficient way to disrupt their enemy's balance. Exploiting the enemy's critical vulnerabilities and capitalizing on the effective imbalance creates a cascading effect that gives the commander an advantage; especially in the operational factor of time. In Clausewitzian terms, this will prevent the enemy sufficient time to recover.[36]

Warfare is a fluid environment; and in order to maintain the advantage in time, the commander must be able to envision subsequent branches to any course of action in order to maintain forward progress. They should be able to evaluate relationships at any given time and be able to foresee possible changes. It is here that the utility in the systems approach

becomes apparent. No matter how many layers are in the system, an understanding of the relationships within the system gives commanders and staffs the ability to observe the operational environment as a whole. Contrary to some opponents' viewpoints, that the systems approach does not allow for regressive planning, it does allow for both regressive and progressive planning and execution at the operational level. It is progressive in terms of capitalizing on the predictive aspect of identifying critical vulnerabilities, but this approach bridges the gap between theory and execution by providing regressive planning as a roadmap that more accurately identifies enemy capabilities that should be avoided and vulnerabilities that must be exploited. In other words, this whole-system approach is predictive in nature and gives operational commanders the required edge in today's asymmetrical operations.

An important utility of this predictive aspect is illustrated in the concepts of *branches* and *sequels* in Joint Operation Planning. Joint doctrine defines a *branch* as a contingency option built into the basic plan and answers the "what if" question, while a *sequel* is a major operation based on possible outcomes from a current operation.[37] If the commanders and staffs understand the context of the entire system, they can answer the contingency questions and more effectively plan for branches and sequels. The systems-type analysis alone may not provide the entire answer, but synthesizing it with operational art gives the commander the ability to combine raw data with their understanding of system interrelationships.

Opponents, such as LtGen. Van Riper, claim that the EBO-type approach only has its utility in air-to-ground targeting, but today's asymmetrical operations warrant a reevaluation of our approach to warfare. The fluid environment seen in today's operations makes it necessary for the commander to have a better predictive tool for branches and sequels. EBO concepts have seen success in operations since DESERT STORM, because of the exceptional

advances in weapons-systems technology. The technological advances in persistent ISR, near real-time intelligence, and the advent of UAVs continue to provide great advantage. These advances give commanders greater situational awareness, and enable them to understand the cause-and-effect relationships of actions in the operational environment. Even though these tools have many positive aspects; systems such as the UAV can also be a detriment to the operational commander when the tactical battlespace is instantaneously broadcast through the strategic level. Because of this, it is especially crucial that operational commanders understand the cause and effects of actions in the operational environment so as to not (virtually) relinquish control of the situation to strategic commanders. In order to better understand the cause and effects before, during, and after operations, the commander must be aware of the key links throughout the system.

Systems Redefined

USJFCOM's EBO Handbook attempted to standardize lexicon, but that was lost when EBO was essentially erased by Gen. Mattis in 2008. Nonetheless, many terms remained scattered throughout joint doctrine and need to be redefined. Table IV illustrates proposed changes (underlined) to the definitions originally adapted from USJFCOM's EBO Handbook.

> **System:** A functionally, physically, and/or behaviorally related group of regularly interacting or interdependent networks; that group of networks forming a unified whole.
>
> **Network:** A functionally, physically, and/or behaviorally related group that can operate independently or with other independent networks.
>
> **Center of Gravity:** The mean center of a system where the balance of power exists; and, if attacked, will have the most decisive effect on the enemy.
>
> **Node:** An element of a network or system that represents a critical capability (person, place or thing).

Key Node: A node possessing a critical vulnerability that, if attacked, provides considerable advantage toward achieving an objective and disrupting a center of gravity (strategic or operational).

Link: An element of a system that represents a behavioral, physical, or functional relationship between nodes.

Key Link: A link possessing a critical vulnerability that, if attacked, provides considerable advantage; and is a critical requirement to one or more key nodes.

Objectives prescribe friendly goals.

Effects describe network behavior and reactions within the system of the operational environment

Tasks direct friendly action.

Table IV (adapted from JFCOM *EBO Handbook* 2006)

A generic visual example of the updated terms is depicted in Figure 2, where key links are darker shaded links connecting key nodes. This example depicts the interrelationships between key nodes and key links that provide the most effective path toward disrupting or destroying the operational center of gravity. For every key node or key link, it is crucial to identify second and third order relationships in order to create a cascading effect while progressing toward the center of gravity.

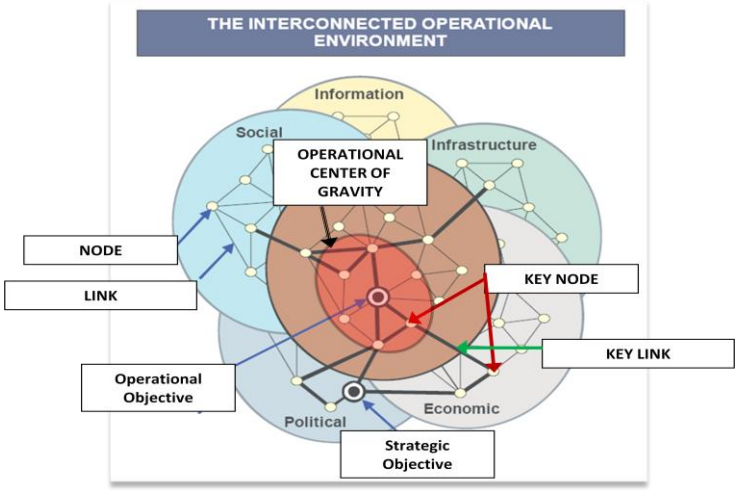

Figure 2. Updated Terms in Operational Environment. (Adapted from JP 3-0)

Conclusions and Recommendations

Critics of EBO disagree with many of its concepts and terms such as *effects,* because they say it relies too heavily on trying to predict the effects of operations. They also disagree with the visualization of the battlespace as a system. However, to its proponents, a systems approach is necessary to help reduce inherent margins of error in operational planning by increasing situational awareness of second and third order effects. Many of today's operations revolve around *effects* assessments like battle damage assessments (from airstrikes, artillery, etc.), initial staff estimates, CBAE, and commander's risk assessments etc. These are examples of only a few of the many *effects* assessments used by commanders and their staffs to maintain their situational awareness of the entire operational environment.

While the term *effect,* in *EBO,* has been at the center of disagreement, EBO's most important utility is the systems analysis aspect of envisioning the network relationships that affect the entire system. By understanding how attacks on one network affect other networks, the commander can then identify future vulnerabilities within the enemy's network. If these potential vulnerabilities are quickly identified and attacked, the cascading effect gives the attacking forces the advantage in time and disrupts the enemy's balance. The advantage in time compliments Clausewitz' concept "if the enemy is thrown off balance, he must not be given time to recover."[38] Where Clausewitz attacked the enemy with force (force-on-force battles) to disrupt their balance, today we must identify and attack vulnerabilities in multiple networks to disrupt the enemy's overall balance.

Opponents and proponents of EBO must realize that variations of the terms are still used in the periphery of the operational design process, and because of that; a standard lexicon is necessary to effectively synthesize the systems and traditional approaches to

design. Advancements in cyber and weapons systems, and asymmetric wars against a lawless enemy require us to elevate our focus on enemy network vulnerabilities that, if attacked, would have the most decisive effect.

Previous EBO terms lacked substantial definitions; but once key terms are redefined and understood, the systems-type approach to operational design deserves reinvigoration in today's operations. Like many other challenges to the status quo, EBO was met with much resistance. Considering this ever present resistance toward that concept, a new title is necessary that accurately reflects the synthesis of systems terms and their utility in joint operational and strategic lexicon today. A title more representative of the synthesis between systems and traditional design is Systems Based Operational Design (SBOD). More important than the "title" itself, the lexicon must be agreed upon and fully incorporated into joint operational design in order to maintain the advantage in today's complex environment.

Notes

(All notes are in shortened form. For full details, see appropriate entry in the bibliography.)

[1] Smith, Daniel, Corbin, Marcus and Hellman, Christopher. *Reforging the Sword. Forces for a 21st Century Security Strategy*, 72, http://www.cdi.org/mrp/reforging-full.pdf (accessed 08 April 2011).
[2] EBO will be used in the rest of the document for all effects-based references including: effects-based approach, and effects-based approach to operations.
[3] Joint Forces Command. *Commander's Handbook for an Effects-Based Approach to Joint Operations.*Handbook, Suffolk, VA: USJFCOM (2006): I-3.
[4] Mattis, James. *Assessment of Effects-Based Operations.* Command Memorandum, Suffolk, VA: USJFCOM, 2008. http://smallwarsjournal.com/documents/usjfcomebomemo.pdf (accessed 23 March 2011).
[5] Ibid.
[6] Ibid.
[7] Van Riper, Paul K. *Point/Counterpoint, EBO There Was No Baby in the Bathwater,* Joint Forces Quarterly/Issue 52, 83.
[8] Ibid.
[9] Vego, Milan. *Effects Based Operations: A Critique,* Joint Forces Quarterly/ Issue 41, 52.
[10] Ibid.
[11] Vego, Milan, *Joint Operational Warfare* (Newport: Naval War College, 2009), VII-3.
[12] Vego, JFQ Issue 41, 55.
[13] von Clausewitz, Carl, *On War* (Princeton: Princeton University Press, 1976), 596.
[14] Dr. Milan Vego, (U.S. Naval War College, Newport, RI), in discussion with author, 18 April 2011.
[15] Vego, *Joint Operational Warfare*, VII-15-16.
[16] Vego, *Joint Operational Warfare*, VII-13.
[17] Ibid.
[18] JP 5-0, IV-11.
[19] Strange, Joe, *Building on the Clausewitzian Foundation So That We Can All Speak the Same Language* (Quantico: Marine Corps War College, 1996), 17.
[20] Echavarria, Antulio, *CLAUSEWITZ'S CENTER OF GRAVITY: Changing Our Warfighting Doctrine-Again!* (Carlisle: Strategic Studies Institute, 2002), 7.
[21] Strange, *Building on the Clausewitzian Foundation So That We Can All Speak the Same Language*, 18.
[22] Echavarria, *CLAUSEWITZ'S CENTER OF GRAVITY: Changing Our Warfighting Doctrine-Again!*, v.
[23] MCDP 1, 47.
[24] Ibid.
[25] Ibid.
[26] MCDP 1-0, 2001, 6-10.
[27] Ibid., 6-12.
[28] EBO Handbook, III-4.
[29] JP 3-0 p IV-10.
[30] Ibid., IV-12.
[31] Ibid., IV-12.
[32] Vego JFQ 41, 54.
[33] Clausewitz, *On War*, 595-596.
[34] Echavarria, *Changing Our Warfighting Doctrine-Again*, 7 (concepts adapted from)
[35] Clausewitz, *On War*, 595-596.
[36] Ibid.
[37] JP 5-0, IV-31.
[38] Ibid.

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